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AGRICULTURAL ECONOMICS RESEARCH

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Alternative Methods of Programming

By Ronald L. Mighell

Linear programming is rapidly finding a place in every working economist's tool chest. Experience with this research technique has reached the point at which the relative efficiency of alternative methods of programming needs careful study. In the accompanying paper such an evaluation is made for one type of problem.

LINEAR programming is one of the promising new research techniques that agricultural economists have been exploring and adapting to their needs. Analysis so far has centered mainly on what the method is and how it works. Less attention has been directed to the problem of the relative efficiency of linear and other methods of programming. The main purpose of this paper is to compare alternative methods of programming (or budgeting) as applied to a special type of problem in the economics of production.

It may be true, as McCorkle and Boles point out, that "linear programming can be used to analyze any economic problem that is susceptible to budgetary analysis," but they would be among the first to acknowledge that at times other procedures may be more efficient.[1] We need to be able to identify more certainly the types of problems in which linear programming is more appropriate and those in which other methods are likely to be more efficient.

This choice among alternative economic tools lies at the heart of the practicing economist's own business of being an efficient technician. Like other entrepreneurs, to make the most effective use of his resources, he must choose between alternative methods of analysis in the light of the best information available. He must decide when to shift from the arithmetic spade to the algebraic power shovel. Much spadework is still required in places where power machinery is too clumsy for efficiency, but power multiplies the output greatly wherever it can be used appropriately.

[1] McCorkle, Chester O., Jr. and Boles, James N. Use of linear programming in cotton acreage and adjustment research in California, 1954, Western Farm Economic Assoc. 27th Annual Meeting. Proc. July 1954.

Terminology

The semantics in this area of production economics are in a rather unhappy state. Many of us are like Jourdain, the rich tradesman who set up as a gentleman in Moliere's *Le Bourgeois Gentilhomme*. Just as Jourdain discovered that he had been using prose all his life without knowing it, we are suddenly finding out that we have been *programming* for a long time without becoming aware of it. Before we can appreciate the place of *linear* programming, we need to understand, in terms of a common language, what we have done heretofore.

In a general sense, any systematic procedure for finding the optimum economic combination of resources used in production may be termed programming. Budgeting, scheduling, coordinating, planning, and similar terms, when used with reference to a systematic way of finding the most profitable combination of resources used in production in a given time period, all are equivalents to programming. This makes programming broad enough to cover almost any systematic technique or procedure used in the field of production economics. In a still broader sense, one might include the whole of economics and refer

to programming in relation to the maximum utilization of resources for human wants. But *linear* programming is evidently intended to be restricted to a narrower field.

Dorfmann has suggested *mathematical* programming as a better term in order to avoid the linear restriction.[2] But this term runs into another difficulty. Systematic mathematical programming to determine highest profit and least cost combinations of resources has been in use for a long time, if arithmetic is part of mathematics. Hence, mathematical programming may easily be construed to include much that linear programming has excluded. For example, it would include all systematic budgeting, all production function techniques, and all the systematic arithemetic and statistical approaches that have been developed through the years.

The linear programming analysts have in mind a special kind of mathematical programming restricted to a class of relationships best handled by a new form of matrix algebra, which in most applied work uses what is known as the *simplex method* of solving a set of linear inequalities to minimize costs or to maximize returns. Linear programming can be illustrated arithmetically or graphically for simple problems. In many instances, such problems could be more quickly solved by arithmetic. Practical use is indicated in many-variable problems in which matrix algebra is more efficient than arithmetic.

To repeat, "programming" may be defined as any *systematic* approach to the solution of the key economic problem of economic combination of resources. "Mathematical programming" is any method of programming that makes use of mathematics. For convenience, we may divide mathematical programming into *arithmetic* and *algebraic* programming. "Linear programming" in its fully developed form is a kind of algebraic programming which uses matrix algebra. It is characterized by linear assumptions, although such assumptions are also found in other kinds of programming.

In what follows, arithmetic programming and linear programming are applied alternatively to one problem as an example of the kind of analysis needed for many different problems before we can know when to use one or the other procedure. In each instance, the choice will depend on the nature of the problem and the number of variables.

Choice of the Optimum Broiler Program

Producers of commercial broilers have a complex economic problem of deciding how many broilers to grow in each lot, how many lots to grow in a year, and at what weight to market each lot. These choices are interrelated, because in a given area of pen space fewer broilers can be raised if they are held to higher weights. Similarly, the number of lots that can be raised in a year is related to the weight at which the broilers are marketed; the higher the weight, the more time needed for each lot and the fewer the numbers of lots.

This problem was analyzed by several economists at about the same time.[3, 4, 5] The basic data used differ slightly and some of the assumptions varied, but the problems were essentially the same. Hansen used arithmetic programming. Judge and Fellows also used it, but they attached an annex with an alternative solution in linear programming. King, using data from Connecticut as did Judge and Fellows, presented the problem in linear programming fashion only.

The objective in these and other early linear programming studies was primarily methodological, but the coincidence of alternative methods of programming applied to the same problem presents the intriguing question of which is the more efficient. In the discusson that follows, the data in Hansen's article are used to present a more complete parallel comparison of the two methods.[6] The tables given in the Hansen article are arranged with the budgets for each process in horizontal lines. The budgets might have been placed in vertical columns, as in the linear programming

[2] Dorfmann, Robert. mathematical or "linear" programming: a nonmathematical exposition. Amer. Econ. Rev., Dec. 1953.

[3] Hansen, Peter L. growing broilers for maximum returns. Agricultural Economics Research. 5: 69–76. 1953.

[4] Judge, George G., and Fellows, Irving F. economic interpretations of broiler production problems, Conn. (Storrs) Agr. Expt. Sta. Bul. 302. July 1953.

[5] King, Richard A. some applications of activity analysis in agricultural economics, Jour. Farm Econ. 35: 823–833. 1953.

[6] A few changes were made to correct minor errors in the data as originally presented.

TABLE A–1.—*Inputs and outputs per broiler at 9 different marketing weights*

Estimated age	Weight	Feed used		Cost of chicks, fuel, mortality, and medicine [2]	Returns per broiler above direct costs, when price per pound is—[3]	
		Quantity	Cost [1]		25 cents	30 cents
Days	*Pounds*	*Pounds*	*Cents*	*Cents*	*Cents*	*Cents*
58	2. 25	5. 4	27. 0	21. 3	7. 9	19. 2
62	2. 50	6. 2	31. 0	21. 5	10. 0	22. 5
66	2. 75	7. 1	35. 5	21. 7	11. 6	25. 3
70	3. 00	8. 0	40. 0	21. 9	13. 1	28. 1
75	3. 25	8. 9	44. 5	22. 1	14. 6	30. 9
80	3. 50	9. 9	49. 5	22. 3	15. 7	33. 2
85	3. 75	11. 0	55. 0	22. 6	16. 2	34. 9
90	4. 00	12. 3	61. 5	22. 9	15. 6	35. 6
96	4. 25	13. 7	68. 5	23. 3	14. 4	35. 7

[1] Price of feed at $5 per 100 pounds.
[2] Mortality estimated at one-half of 1 percent a week, with cost of fuel, medicine, and chicks estimated at 20 cents per chick.
[3] Direct costs include feed, chicks, mortality, fuel, and medicine, but not labor and fixed costs such as buildings, equipment, interest, taxes, and insurance. Cost of litter is estimated to offset value of manure.

TABLE A–2.—*Annual returns above direct costs at 9 different marketing weights* [1]

Estimated age plus 2 weeks	Weight	Space per bird	Broilers per lot [2]	Lots per per year [3]	Production per year	Annual returns, above direct costs, when price per pound of broilers is—[4]	
						25 cents	30 cents
Days	*Pounds*	*Square feet*	*Number*	*Number*	*Number*	*Dollars*	*Dollars*
72	2. 25	0. 50	20, 000	5. 1	102, 000	8, 058	19, 584
76	2. 50	. 57	17, 544	4. 8	84, 211	8, 421	18, 947
80	2. 75	. 64	15, 625	4. 6	71, 875	8, 338	18, 184
84	3. 00	. 71	14, 085	4. 3	60, 566	7, 934	17, 019
89	3. 25	. 78	12, 821	4. 1	52, 566	7, 675	16, 243
94	3. 50	. 85	11, 765	3. 9	45, 884	7, 204	15, 233
99	3. 75	. 92	10, 870	3. 7	40, 219	6, 515	14, 036
104	4. 00	. 99	10, 101	3. 5	35, 354	5, 515	12, 586
110	4. 25	1. 06	9, 434	3. 3	31, 132	4, 483	11, 114

[1] Time and space are the only limiting factors; labor and capital are available in ample quantities.
[2] Based on a broiler house of 10,000 square feet.
[3] Number of lots per year obtained by dividing 365 by estimated age plus 2 weeks in each weight group.
[4] Return per bird above direct costs as in table A–1.

approach. The choice of arrangement is mainly a matter of convenience.

Arithmetic Programming

Let us first consider the arithmetic approach. The essential data and computations are given in tables A–1 and A–2. Table A–1 shows everything essential for reaching a decision for a single lot of broilers if subsequent lots or other enterprises were not conflicting elements. For this example, it is assumed throughout that the selling price per pound is constant regardless of weight or season. Table A–2 shows the essential steps in estimating the annual production that is possible with birds carried to different weights in a broilerhouse of 10,000 square feet. Annual returns above direct costs are shown for two prices of broilers—25 and 30 cents a pound. The most profitable combination by this measure can be selected at once for each price.

TABLE L–1.—*Input-output budgets per straight-run broiler at 9 different weights*

Item	Production process								
	A	B	C	D	E	F	G	H	I
Weight—pounds	2. 25	2. 50	2. 75	3. 00	3. 25	3. 50	3. 75	4. 00	4. 25
Age + 2 weeks—days	72	76	80	84	89	94	99	104	110
Space per bird—sq. ft.	. 50	. 57	. 64	. 71	. 78	. 85	. 92	. 99	1. 06
Total pen space—days—sq.-ft. days	36	43	51	60	69	80	91	103	117
Feed per bird—pounds	5. 4	6. 2	7. 1	8. 0	8. 9	9. 9	11. 0	12. 3	13. 7
Feed costs per bird [1]—cents	27. 0	31. 0	35. 5	40. 0	44. 5	49. 5	55. 0	61. 5	68. 5
Other direct costs per bird [2]—do	21. 3	21. 5	21. 7	21. 9	22. 1	22. 3	22. 6	22. 9	23. 3
Total direct costs—do	48. 3	52. 5	57. 2	61. 9	66. 6	71. 8	77. 6	84. 4	91. 8
Total returns at 25 cents—do	56. 2	62. 5	68. 8	75. 0	81. 2	87. 5	93. 8	100	106. 2
Returns above direct costs—do	7. 9	10. 0	11. 6	13. 1	14. 6	15. 7	16. 2	15. 6	14. 4
Total returns at 30 cents—do	67. 5	75. 0	82. 5	90. 0	97. 5	105. 0	112. 5	120. 0	127. 5
Returns above direct costs—do	19. 2	22. 5	25. 3	28. 1	30. 9	33. 2	34. 9	35. 6	35. 7

[1] Price of feed at $5 per 100 pounds.
[2] Mortality estimated at 0.5 percent a week; costs of fuel, medicine, and chicks @ 20 cents per chick.

TABLE L–2.—*Inputs required to yield $1,000 returns above direct costs for straight-run birds*

[At 25 cents a pound]

Item	Production process								
	A	B	C	D	E	F	G	H	I
Broilers—number	12, 658	10, 000	8, 621	7, 634	6, 849	6, 369	6, 173	6, 410	6, 944
Pen space—sq. ft.	6, 329	5, 700	5, 517	5, 420	5, 342	5, 414	5, 679	6, 346	7, 361
Pen space-days—1,000 sq.-ft. days	455. 7	433. 2	441. 4	455. 3	475. 4	508. 9	562. 2	660. 0	809. 7
Feed—cwt.	683. 5	620. 0	612. 1	610. 7	609. 6	630. 5	679. 0	788. 4	951. 3
Feed costs—dollars	3, 417. 7	3, 100. 0	3, 060. 5	3, 053. 6	3, 047. 8	3, 152. 7	3, 395. 2	3, 942. 2	4, 756. 6
Other direct costs—do	2, 696. 2	2, 150. 0	1, 870. 8	1, 671. 8	1, 513. 6	1, 420. 3	1, 395. 1	1, 467. 9	1, 618. 0
Total direct costs—do	6, 113. 9	5, 250. 0	4, 931. 3	4, 725. 4	4, 561. 4	4, 573. 0	4, 790. 3	5, 410. 1	6, 374. 6

TABLE L–3.—*Production process that maximizes returns above direct costs over a 1-year period for straight-run boilers* [1]

[25 cents a pound]

Item	Production process								
	A	B	C	D	E	F	G	H	I
Percentage of available pen space [2]	63. 3	57. 0	55. 2	54. 2	53. 4	54. 1	56. 8	63. 5	73. 6
Percentage of available pen space-days [2]	12. 5	11. 9	12. 1	12. 5	13. 0	13. 9	15. 4	18. 1	22. 2
$1,000 lots—number	8. 00	8. 40	8. 26	8. 00	7. 69	7. 19	6. 49	5. 52	4. 50
Annual returns above direct costs—dollars	8, 000	8, 400	8, 260	8, 000	7, 690	7, 190	6, 490	5, 520	4, 500

[1] Assumes 10,000 square feet of floor space and 3,650,000 sq.-ft. days of time available. Other inputs are not limited.

[2] Quantity of each factor used by each production process (at the $1,000 net return level) as a percentage of the total supply of that factor.

TABLE L–4.—*Inputs required to yield $1,000 returns above direct costs for straight-run birds*

[At 30 cents a pound]

Item	Production process								
	A	B	C	D	E	F	G	H	I
Broilers—number	5, 208	4, 444	3, 953	3, 559	3, 236	3, 012	2, 865	2, 809	2, 801
Pen space—sq. ft	2, 604	2, 533	2, 530	2, 527	2, 524	2, 560	2, 636	2, 781	2, 969
Pen space-days—1,000 sq.-ft. days	187. 5	192. 5	202. 4	212. 3	224. 6	240. 6	261. 0	289. 2	326. 6
Feed—cwt.	281. 2	275. 5	280. 7	284. 7	288. 0	298. 2	315. 2	345. 5	383. 7
Feed costs—dollars	1, 406. 2	1, 377. 6	1, 403. 3	1, 423. 6	1, 440. 0	1, 490. 9	1, 575. 8	1, 727. 5	1, 918. 7
Other direct costs—do	1, 109. 3	955. 5	857. 8	779. 4	715. 2	671. 7	647. 5	643. 3	652. 6
Total direct costs—do	2, 515. 5	2, 333. 1	2, 261. 1	2, 203. 0	2, 155. 2	2, 162. 6	2, 223. 3	2, 370. 8	2, 571. 3

TABLE L–5.—*Production process that maximizes returns above direct costs over a 1-year period for straight-run broilers* [1]

[30 cents a pound]

Item	Production process								
	A	B	C	D	E	F	G	H	I
Percentage of available pen space [2]	26. 0	25. 3	25. 3	25. 3	25. 2	25. 6	26. 4	27. 8	29. 7
Percentage of available pen space-days [2]	5. 1	5. 3	5. 5	5. 8	6. 2	6. 6	7. 2	7. 9	8. 9
$1,000 lots—number	19. 61	18. 87	18. 18	17. 24	16. 13	15. 15	13. 89	12. 66	11. 24
Annual returns above direct costs—dollars	19, 610	18, 870	18, 180	17, 240	16, 130	15, 150	13, 890	12, 660	11, 240

[1] See footnote 1, table L–3.
[2] See footnote 2, table L–3.

Linear Programming

This example of linear programming is presented in arithmetic terms, but it follows the lines of reasoning that would apply if matrix algebra were used. Table L–1 contains the same data as table A–1 in the preceding arithmetic approach.

Table L–2 is derived from L–1 by computing the inputs required to yield $1,000 return above direct costs under each process, with a selling price of 25 cents. A similar table must be constructed for any other selling price—for example, L–4 for 30 cents.

Table L–3 (for 25 cents) is the final table. The data in this table are derived from the preceding tables. They lead to the solution for each process, showing the number of $1,000 lots that can be produced annually. Table L–5 is the corresponding table derived from L–4—to show the final results with a 30-cent price per pound.

Note that the results obtained by arithmetic and linear programming are identical except for minor differences caused by rounding numbers. Carrying more digits would eliminate these differences.

Ray Charts

The information in tables L–2 and L–4 can be presented in a ray chart such as figure 1. The broken lines that connect the plotted points are net revenue isoquants which show the processes that yield $1,000 net return above direct costs. In this particular example, it is not possible to select the optimum production plan from a ray chart, as might be supposed for the example given in Connecticut Bulletin 302. The Connecticut example is almost unique in this respect. The present examples are more nearly typical. The reason is that with two fixed factors already owned, there is no rational basis for establishing a price line to

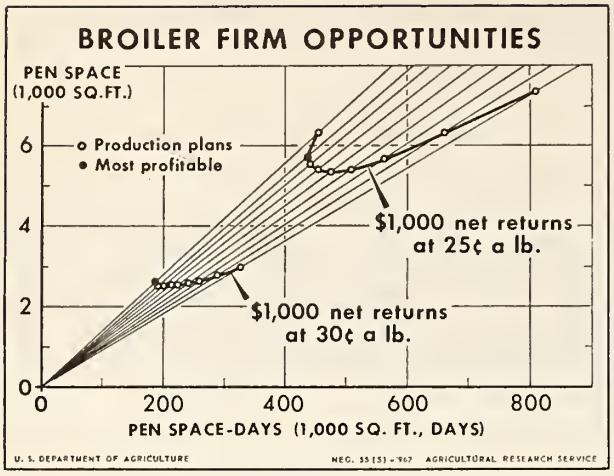

Figure 1.

touch one of the corners on the isoquant. Consequently, the most profitable combination cannot be ascertained graphically in this way.

Interpretation

Our comparison shows that arithmetic programming is more efficient than linear programming for this particular problem. Why is this? Do we have here a type of problem that can be recognized in advance and for which arithmetic programming can be prescribed?

Careful examination of the nature of the commercial production of broilers shows that we do have a special type of problem. The number of possible processes is restricted by the limited range of marketing weights possible, and by the number of successive lots that can be grown in a given time period. Moreover, the range of choice does not extend to combinations or mixtures of processes. The problem is to select the single most profitable process or system from the limited number that are feasible—nine in this instance, if interpolations are overlooked. It is thus not a case of maximizing several linear inequalities as in linear programming. Rather, it means selecting the most advantageous of several discrete and unique alternatives. Although the problem can be solved by going through some of the routine of linear programming, it can be solved more rapidly by direct arithmetic.

It may be worth pointing out that the number of limiting factors does not greatly affect the ease of solution. In this example, there is really only one limiting factor, space-time. Suppose labor were also limited to an amount sufficient to care for a maximum of 15,000 birds. This restricts the choice to those processes that have no more birds on hand at one time than this number. No additional work is necessary, as this can be read from table A–2 as already calculated. In fact, any number of limitations could be imposed without adding work, except for the calculation of the pertinent data for the quantity of the limiting factor needed for each process.

Application

How shall we recognize problems in which arithmetic programming of this particular kind can be applied? Perhaps the following criteria will help:

(1) Specialized single-enterprise production.

(2) Limited number of alternative production possibilities spread over the potential range.

(3) Each production possibility unique, no mixtures or combinations possible for biological or other technical reasons.

(4) Variable range in maturity and marketing dates.

(5) Several successive repetitions of production process within a given year or other time period.

Obviously, few examples in agriculture will meet these criteria as well as the production of commercial broilers. In the livestock production field, turkeys that are produced continuously like broilers come nearest. Commercial production of rabbits for meat or commercial production of any other small meat animal would offer similar choices. A few specialized hog producers who buy feeder pigs from pig hatcheries and produce continuously may have the same kind of problem.

Crop production may offer some examples, but these must be few because there are few situations in which delayed harvesting would be feasible. A few specialized types of greenhouse production might fall in this category.

Related Problems

A type of problem that is somewhat similar is represented by less closely related systems of production. For example, several distinct systems of feeding cattle may be compared from the viewpoint of long-run returns. Or distinctly different

systems of crop rotation may be studied similarly. Comparative analysis of this kind, if done systematically and carefully, deserves to be called programming, although it would not lend itself to linear programming analysis.

Conclusion

Commercial broiler production presents a type of economic problem for which a special kind of arithmetic programming is more appropriate than is linear programming. The fact that linear programming proves to be the less efficient method in this particular problem should not be interpreted as a vote of no confidence. Rather it suggests the need for further comparative testing of alternative methods of programming as applied to each of many different types of economic problems which vary as to characteristics and in complexity. For some problems, linear programming will prove without doubt a more efficient procedure. But more testing needs to be done before we can be certain of their relative efficiencies in each set of circumstances. Eclecticism is a special virtue in this area. One of the special merits of linear programming is that the technique forces the analyst to list his assumptions in a systematic way, and, having done so, he is more likely to test them for reasonableness. This in turn helps in the selection of the most appropriate programming method.

Validity of Objective Estimates of Corn Yield

By Walter A. Hendricks

As part of an extensive research program, the Agricultural Estimates Division of Agricultural Marketing Service is investigating objective methods for estimating and forecasting corn yields. This paper is concerned only with one question: To what extent can differences in estimates of yield per acre, derived from weighing small samples of the crop just before harvest, be reconciled with yields reported by farmers and the official yield estimates derived from such reports? The present status of information on that question is given here without distracting attention from the main issue by including a mass of technical statistical detail. It should be emphasized, however, that the materials contained in this article represent only the preliminary findings of this particular research project, and that final conclusions with respect to the validity of official corn-yield estimates, compared with those obtained by other methods, cannot be made until the research program in this area has been completed and evaluated.

OFFICIAL yield estimates and yields reported by farmers for corn are generally lower than those obtained by weighing small preharvest samples of the crop and adjusting the average weight to a standard moisture content. To illustrate, statewide objective yield surveys conducted by the Crop Reporting Service and cooperating State agencies in Alabama in 1948, and in North Carolina and Virginia in 1949, gave the following results in relation to present official estimates:

	Objective estimate	Official estimate	Official estimate as percent of objective estimate
	Bu/Acre	*Bu/Acre*	*Percent*
Alabama (1948)	26	21. 0	81
North Carolina (1949)	41	31. 5	77
Virginia	55	42. 0	76

For Alabama, the objective estimate was in

terms of a 14-percent moisture content, whereas for North Carolina and Virginia it was in terms of a 15.5-percent moisture content. But converting the Alabama figure to a 15.5-percent moisture basis would raise the computed yield less than 0.5 bushel per acre. The official estimates are not defined rigorously, but they are generally assumed to be in terms of a moisture content at approximately that level.

Any technical discussion of the discrepancies between the objective estimates and the corresponding official estimates, which are based largely on data reported by farmers, is hampered by the lack of a clear-cut definition of the official estimate in other respects also. It is generally accepted that data reported by farmers refer to that part of the crop actually taken from the field in the harvesting operation.

To make the objective estimate comparable with the official estimate a "normal harvesting loss" should be deducted. No information on the size of that loss was available when these surveys were made, but it was not thought to be large enough to account for all of the observed differences. This forces us to inquire whether the objective estimate would be too high because of a bias in the small samples, even if proper allowance were made for harvesting loss, or whether data reported by farmers are at too low a level.

As often pointed out, biases can creep into objective estimates that are based on small harvested samples. It is also recognized that the official estimates are essentially at a level corresponding to yields derived from census data by dividing total reported production by total reported acreage. Even if production is properly reported, the derived yield per acre would not be comparable with the objective estimate if farmers reported gross field sizes instead of the net acreages on which corn was actually standing. Until recently we had no information on just what farmers include in their reported acreages.

Data From Research Project in 10 Southern States

As part of the Agricultural Estimates research program currently in progress, an objective yield estimate was computed by means of harvesting small samples of corn on a sample of fields spread over this 10-State region. Results were comparable with those found in previous work. The objective yield indication, at 15.5-percent moisture content, was 21.8 bushels per acre. The average of the present official estimates for the same States is only 16.4 bushels per acre. On a relative basis the official estimate is 75 percent as large as the objective estimate.

In this study a post-harvest gleaning of sample fields showed that an average of 2.0 bushels of corn per acre was left behind as harvesting loss. Assuming that such corn would not be included in a farmer's reported production, the objective yield indication should be reduced by that quantity. This gives an objective estimate of 19.8 bushels per acre.

A comparison was also made between farmers' reported field sizes and corresponding measurement data. This comparison indicated that the net acreage on which corn was actually standing for harvest amounted to 97.8 percent of the reported acreage.

This raises a question regarding the appropriate definition of yield per acre. If yields are defined in terms of the farmer's concept of acreage, the indication of objective yield relating to a net acreage should be reduced by 2.2 percent to make it comparable with that definition. On the other hand, if yield is defined in terms of net acreage, the official estimate should be divided by 0.978 to make it comparable with the objective estimate.

Convincing arguments could be advanced in favor of either of those two concepts, but the latter viewpoint was adopted here. The official estimate was converted to a "net-acreage" level. Such an adjustment raises the official yield to $16.4/0.978 = 16.8$ bushels per acre.

The objective yield estimate of 19.8 bushels per acre, obtained after adjusting for harvesting loss, and the official estimate of 16.8, obtained after adjusting for overstatement of acreage, should be comparable. But the official estimate is still only 85 percent as large as the objective yield estimate. We are left in the position of having to decide which of the two is closer to the truth.

Research at Iowa State College

For the last 2 years more detailed studies on forecasting and estimating corn yields have been conducted, in cooperation with the Statistical Laboratory of Iowa State College, on samples of

farms covering Crop Reporting Districts 2, 5, and 8 in Iowa. These districts cover the central third of the State, north to south.

In the 1953 studies the unadjusted objective yield indication was 79.3 bushels per acre. The yield computed from the farmers' reported acreage and production was only 58.3 bushels. The yield derived from the reported data is only 74 percent as large as the objective estimate. Here we find a harvesting loss of 7.8 bushels to be applied to the objective estimate. The net acreage for harvest, as determined by measurement, was 97.2 percent of the farmers' reported acreage for the same fields.

Those two statistics provide an adjusted objective yield of $79.3-7.8=71.5$ bushels per acre and a comparable adjusted reported yield of $58.3/0.972=60.0$ bushels. The comparable adjusted reported yield is still only 84 percent as large as the adjusted objective yield, even though both are supposedly on the same basis.

The similarity of these results, percentagewise, with those obtained in the 10 Southern States is striking, considering the large difference in levels of yield between the two regions. The ratio of the official estimate to the unadjusted objective estimate was 75 percent in the Southern States. The ratio of reported yield to the objective estimate was 74 percent in Iowa. Harvesting losses were estimated at 9 percent in the South and 10 percent in Iowa. Measured net acreage was 2.2 percent below reported acreage in the South and 2.8 percent below reported acreage in Iowa. Adjustments for harvesting loss and acreage corrections reduce the spread between the objective estimate and the judgment estimate to 15 percent in the South and to 16 percent in Iowa.

As the adjusted objective and judgment estimates are presumably comparable, this latter difference must be explained as a bias in the objective estimates, or as an understatement of yields reported by farmers, or both. To settle that question it would be helpful to have some objective data on total quantities of corn actually harvested by farmers for comparison with reported data. Such objective data are difficult to obtain. The nearest we have come to such data is a set of measurements of corn in the crib shortly after harvest, made by workers of Iowa State College as part of a research study, in 1954.

That year the objective yield estimate for the same area covered in 1953 was 74.0 bushels per acre, with an average of 55.7 bushels per acre reported by farmers on a gross acreage basis. The reported figure is again only 75 percent as large as the objective indication. The net acreage on which corn was actually standing for harvest was 2.2 percent below the reported gross acreage. Measured harvesting loss amounted to 8.3 bushels per acre.

We thus have adjustments similar to those made previously: the objective estimate becomes $74.0-8.3=65.7$ bushels per acre and the judgment estimate becomes $55.7/0.978=56.9$ bushels per acre. The adjusted judgment estimate is still only 87 percent of the adjusted objective estimate.

But in this study we have, for the first time, an objective indication of the quantity of corn actually harvested by the farmers. The volume of corn in cribs was measured on 50 of the farms and the results were compared with the farmers' estimates of bushels of corn in the cribs.

If the farmers' estimates were correct, they would imply an average conversion factor for the corn in these cribs of 2.87 cubic feet per bushel. A significantly different estimate of the number of bushels is obtained if the standard conversion factor [1] of 2.50 cubic feet per bushel is used. Applying that factor to the measured volume of corn in the farmers' cribs gives an indication that the bushels of corn in the cribs was understated by 15 percent.

The adjusted judgment yield of 56.9 bushels per acre, corrected for that understatement, becomes $(1.15)(56.9)=65.4$ bushels. This agrees almost perfectly with the objective indication of 65.7 bushels, obtained after applying the deduction for harvesting loss.

Conclusions

The evidence so far thus indicates that objective corn-yield estimates, adjusted for harvesting loss under farm operating conditions, can be accepted as valid estimates of yield per acre.

[1] It should be pointed out that the standard factor is in the nature of a national average which may not be fully applicable to corn in different locations at different times of the year, particularly with respect to moisture content. Work planned at Iowa includes an effort to ascertain the most appropriate factors to be used for such conversion.

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Yield per acre is defined in terms of net acres on which corn is standing for harvest. The harvesting loss appears to be of the order of 10 percent of the unadjusted objective indication of yield.

Estimates of yield per acre, derived from data reported by farmers, need to be adjusted to a net acreage level to compensate for parts of the field upon which no corn is standing for harvest, but which presumably are included in the acreage customarily reported by farmers. In round numbers, the reported acreage appears to be about 2.5 percent too high.

In addition to the acreage adjustment, it appears that there may be an understatement of as much as 15 percent in farmers' reported data on production. This factor admittedly applies to corn that is already in the crib. For corn that is not cribbed, the accuracy of that factor may be questioned. But it is perhaps reasonable to infer that if cribbed corn is understated by that amount, uncribbed corn is probably understated by at least that much.

To summarize, let us apply these average adjustments to all of the objective and judgment estimates of yield discussed in this paper in one table. The results are as follows:

Comparison of Objective and Judgment Yield Estimates

Area	Objective Estimate		Judgment Estimate	
	Unadjusted	Adjusted for harvesting loss	Unadjusted	Adjusted for acreage and understatement of production
	Bu/Acre	*Bu/Acre*	*Bu/Acre*	*Bu/Acre*
Alabama (1948)	26	23. 4	[1] 21. 0	24. 8
North Carolina (1949)	41	36. 9	[1] 31. 5	37. 2
Virginia (1949)	55	49. 5	[1] 42. 0	49. 6
Southern States (1954)	21. 8	19. 6	[1] 16. 4	19. 4
Central Iowa (1953)	79. 3	71. 4	[2] 58. 3	68. 8
Central Iowa (1954)	74. 0	66. 6	[2] 55. 7	65. 7

[1] Official estimate. [2] Reported data.

It is clear that even the use of fixed adjustment factors does a creditable job of reconciling the objective and judgment yield estimates, particularly when it is remembered that some divergence between the two can be charged to sampling error.

Elmer Working: The Demand for Meat

A Review by Harold F. Breimyer

The last few years have seen a resurgence of creative effort in commodity price analysis, following a decade or so when analysts exploited but did not greatly extend the brilliant achievements of the 1920's and early 1930's. Much of the current research is the product of new talent. Some, however, including the publication reviewed here, is contributed by members of the original school. This study reflects insight and maturity gained from long experience. It also presents some new viewpoints and techniques in an always challenging area.

IN ANY RANKING of factors that affect the prices of farm products, the elasticity of demand stands high. American agriculture, distinguished as it is by a relatively uncontrolled and variable output, is highly subject to the degree of elasticity or inelasticity characterizing its market. Statistical studies have shown the demand for most farm products to be inelastic, and the clash of ever-changing supply meeting inelastic demand explains much of the instability in prices for those products. Even the farm programs devised to smooth out price movements are by no means free of the limitation imposed by the particular demand elasticities for various products.

A second concept basic to price analysis is income elasticity—the relation of nonfarm price and income levels to demand for farm products. Estimating this relationship has engaged the energies and ingenuities of economists for a generation.

The companion principles of price elasticity and income elasticity of demand are treated expertly by Professor Elmer Working in his report *Demand for Meat*, recently published by the Institute of Meat Packing at the University of Chicago.[1] Professor Working, formerly of the University of Illinois, is now head of the Department of Agricultural Economics of the State College of Washington. His bulletin is one of the best studies in price analysis to appear since the end of the war.

As befits a skilled and veteran analyst, in his new research Professor Working eschews mere repetition of conventional price studies. His special concern is with the "dynamics" of demand. By this term, he means not longtime evolutions in tastes, population, or other factors, but "situations where a change in a causally important variable has a different effect depending upon its rate of change or upon the length of time which has elapsed since the change occurred." As variables "causally important" to meat prices he considers the quantity of meat consumed, the general price level, and the real income of consumers.

Major findings of his dynamic analysis are set forth in the introductory "Highlights." First, "There is a difference between the short-run and the long-run elasticity of demand for meat. . . . In the short run the demand for meat is somewhat inelastic. . . . The long-run demand for meat at retail is elastic." Second, "Changing price levels influence the real demand for meat." During inflation or deflation, meat prices outrun the general level of commodity prices. Third, "Demand for meat is more affected by long-continued changes in real incomes than by equal changes in shorter duration." (p. xi)

In this study, Working fulfills promises he made to himself 28 years ago, and those of other authors as well. In his classic "What Do Statistical Demand Curves Show?" he had pondered the terms "static" and "dynamic," without clear resolution.[2] In an article published in 1932 he emphasized distinctions between "market demand curves, short-time normal demand curves, and long-time normal demand curves."[3] Mighell and Allen, in

[1] Available from the Institute at $1 per copy.

[2] WORKING, E. J. WHAT DO STATISTICAL "DEMAND CURVES" SHOW? Quart. Jour. Econ. 41: 212–35. 1927.

[3] WORKING, E. J. INDICATIONS OF CHANGES IN THE DEMAND FOR AGRICULTURAL PRODUCTS. Jour. Farm Econ. 14: 239–55. 1932.

1939, elaborated the thesis, observing that all demand analysis to that date had been "cast in terms of instantaneous or short-time schedules." By this they meant the customary analysis of annual data. No work, they said, had "given us an adequate approach to . . . consumers' response to price over more than the short term." And, "use of a short-time curve . . . underestimates the extent of the response when . . . new prices are to be in effect for a period of years." [4]

Working's analysis of dynamic and of long-time influences in demand for meat has a significance far transcending that commodity. Insofar as his conclusions are valid for meat, they probably have bearing on all farm products. And they are weighty.

For not only have price analysts been chained to 12-months-total data in their statistical investigations, but policy makers, accepting the statisticians' results, have been similarly bound. If there are "dynamic" relationships not revealed in the more routine analyses, this is important knowledge.

Measures of Nonfarm Demand

Agriculture has been notoriously subject to the exhilaration of an upsurging general price level and industrial boom. It has been equally sensitive to a general decline in nonfarm prices and income. All analyses of prices of farm products, whether aggregative or individual, employ some measure of nonfarm demand conditions as an indicator of demand for farm products. In multiple correlation analysis this becomes a demand shifter. Years ago the wholesale commodity price index was the favorite statistic for the purpose. Later, such series as factory workers' payrolls were popular. More recently, disposable income of consumers has been widely accepted as a demand shifter.

Yet the precise connection between farm and nonfarm prosperity continues to baffle analysts and laymen alike. The jump in farm product prices and incomes after World War II to positions "off the chart" was perplexing. Now, in 1955, agriculture is scarcely participating in an industrial boom. Working's study of the demand for meat offers some interesting new ideas on the nature and measurement of nonfarm demand.

Though the terms are not used, Working seems to recognize two basic, and conflicting, features of demand relationships: First, the relatively volatile free-market behavior of farm product prices, in contrast with more inflexible and established prices for many nonfarm commodities and most services; and second, the familiar Engel's law, which observes that a smaller percentage of consumers' incomes is spent for food at the higher than at the lower income levels. Opposing effects of the two characteristics are seen during an inflationary upswing, when the first gives an extra lift to demand for farm products, but the second is a restraining influence.

How can these two factors be handled statistically? Working's answer is: just treat the price-behavior element as a function of the general price level, and treat Engel's law as relating to real income. Other analysts have done this, yet the method is found in few published price analyses. The analytical procedure is to separate the series for disposable income of consumers into its price level and its real income components. Each becomes an independent variable. In Working's correlations the coefficient for the effect on meat prices of a 1-percent change in the consumers' price index is found to be 1.18. This is a high responsiveness, and is consistent with the close relation often observed between farm-product prices and the general price level. For a 1-percent change in real income, on the other hand, Working's coefficient is 0.73. This is at least in the lower direction that would be suggested by Engel's law.

To make the analysis dynamic, Working considers next the effect of an abrupt change in the price level. For a separate factor, the ratio of the consumers' price index for a given year to its average of the preceding 5 years, he obtains a sizable coefficient. This is statistical evidence of the sensitivity of meat prices to inflationary or deflationary price trends, apart from their basic relationship to the level of commodity prices. Or, as Working concludes, "given equal deflated per capita incomes in 2 years, the per capita demand curve for meat will apparently be higher when the Consumers' Price Index has been rising than when it has been falling."

A hypothetical example will illustrate. If, after

[4] Mighell, R. L. and Allen, R. H. demand schedules—"normal" and "instantaneous." Jour. Farm. Econ. 21: 555-69. 1939.

a period of stability, the general price level increases 1 percent owing to inflation, without any rise in real product of the economy or real income, by Working's simpler analysis of price levels the price of meat would increase 1.2 percent. But by this "dynamic" analysis it would rise 1.4 percent the first year. If the new conditions remained unchanged, the price would settle back to a net gain of 1.0 percent after the fifth year.

Regrettably, in his dynamic analysis Working did not continue to separate current disposable income into its two parts of price level and real income. When this reviewer made this refinement, he found the first-year effect to be not 1.4 percent but 1.8 percent. And the net elevation after 5 years to be 1.1 percent.

In this last analysis the regression on real income is only 0.54—a reasonable figure that is even more in accordance with Engel's law and budget studies than is Working's factor of 0.73.

Thus a 1-percent increase in real income enhances the price of meat much less than does a comparable increase in the price level. But, to be sure, each gain in price from the former source is a "real" gain to producers of meat, for the purchasing power of meat is equally enhanced. Moreover, if a higher real income persists, its benefits continue to grow. Working finds in still another correlation that after 10 years of a new level of real income, 1 percent greater than the old, the price of meat would finally have reached a point probably more than 1.1 percent above its starting value. This is a greater gain, over time, than from price inflation! To meat prices, inflation may be the hare; and the increase in real income may be the victorious turtle.

Working still is not completely satisfied. Looking for a more streamlined analysis of demand, he sees in the improvised techniques just described a suggestion of a "possibility of using some simple index of demand shifts which will reflect both changes in (real) disposable income and effects of a changing price level." Further, "the Consumers' Price Index is composed of some prices which are more flexible than others. If we divide per capita disposable income, not by the entire price index, but by an index of the slower-moving components, perhaps we should have an approximation of the desired single index of demand shifts for meat."

The languid components of the consumers' price index he chooses as a deflator are rent; fuel, electricity, and ice; and miscellaneous. The specially deflated income he calls Demand Index A. In essence, this index is a measure of income in terms of those consumers' cost items that advance most slowly during inflation and fall most slowly during deflation, but that creep upward during a period of stable price level and rising real income. Use of Demand Index A is a recognition of a fundamental difference in price-making behavior between commodities whose price response is volatile, and those whose prices are not only slow-moving but semi-contractual in nature.

There is perhaps more empiricism than sophisticated theory in the construction of Demand Index A, and more pragmatism than rationalization in its application. When it is used to account for prewar prices of meat, it works. And when it is modified into Demand Index B by substituting consumers' expenditures for disposable income, it explains the otherwise inexplicable postwar prices, at least through 1952.

The Elmer Working techniques for relating price of meat to nonfarm prices and incomes are not the final word. Doubtless, their author would not claim them to be. Nonetheless, the general attack and its implications are to be taken seriously. Perhaps it is hard to explain just why a new level of prices or real income that lasts 24 months has a materially different effect on the price of meat than one that endures only 12 months. But most students of Marshallian principles recognize a valid distinction between long-run and short-run influences. And to all observers of the economic scene, a rather unsteady economic relation between farm and nonfarm economies is all too obvious. Working's techniques may need revision and improvement, but their results merit attention.

Dynamics in Price Elasticity

Dynamics of price elasticity of demand also are investigated by Working. To his basic analysis, he adds first the 5-year history of meat consumption, and as a later variation, the previous 10-year average. Whereas he gets a price-flexibility factor of about -1.3 for current year's consumption, the factor for 5-year average consumption is -1.05, and the factor for 10-year

average consumption is −0.81.[5] Thus, he says, "we may presume that in the long run the demand for meat is less inelastic than in the short run." The factor of −0.81, of course, is decidedly on the elastic side.

These results corroborate theoretical hypotheses and much popular opinion that consumers are slow to react to a change in supply or in price of certain commodities, particularly staples regarding which there is much habit or custom in consumption. Only after a new abundance or a new scarcity has lasted a while do consumers adjust fully. Examples are legion of extremely inelastic response to very short-run changes in supply, for every marketer of farm products has seen short dips and rises out of all proportion to the level of supply. Working demonstrates the opposite reaction over a long period of time.

Here again the technique is not above question, but the results cannot be disregarded. Many farm policies are built in part on the inelasticity of demand reported by statisticians from their analyses—all of short-term nature. When a price gain is achieved by lowered supply, is it enduring? According to Working's analysis, if the consumption of meat is reduced 1 percent, the price will increase 1.3 percent the first year. It will sag thereafter; after 5 years it will be 1.0 percent above its starting point, and after 10 years it will be only 0.8 percent up.

The foregoing numerical derivations made by the reviewer from Working's equations are believed correct. A further interpretation is more difficult. Working is willing to regard the factors for 5- and 10-year consumption histories as "a closer approximation to a long-run demand curve." But remembering the author's pioneering study "What Do Statistical Demand Curves Show?" it is surprising to find no attempt here to disassociate curve description from curve shifting. Do the values for 5- and 10-year consumption describe new long-run curves, or only a shifting of annual curves?

Mighell and Allen[6] contend the interpretation does not matter. For some purposes this is true. But this reviewer is not satisfied. He believes that: (1) It is even harder to separate demand curves from supply curves in a long-run than in a short-run analysis; (2) the values of −1.05 for a 5-year average and −0.81 for a 10-year average are *terminal* values; they show the net result at the end of that period. This is not the same as an *average* 5-year or 10-year curve. This reviewer admits a preference for the curve-shifting view. Without belaboring the issue, he prefers to think that continuation of a supply level itself acts as a demand shifter.

[5] Price flexibility as used here is the percentage change in price accompanying a 1-percent change in consumption. It is the reciprocal of price elasticity.

[6] Op. cit.

Other Findings Reported by Working

Numerous other findings are reported by Working, most of them of less import than those we have mentioned. He finds the elasticity of demand for beef and for pork not much different from unity. He differs from most analysts, who have reported a moderately inelastic short-run demand. Like others, he discovers evidence of a long-time upward trend in the demand for beef relative to that for pork, particularly the fat cuts of pork.

In methodology, Working insists that the price influence of a competing meat should be allowed for by holding constant the consumption of the meat, not its price, as it is the consumption that is regarded as predetermined for both meats. In connection with this plausible rule he makes a verbal slip—rare in this report. Starting with an increase in the price of pork he observes that a rise in either the price or the consumption of other meats would follow unless there were a concurrent increase in incomes of consumers. He should have said a concurrent *decrease* in incomes.

In analytical technique, Working takes note of the theorem that even random errors in x's will affect the slope of the regression of y on x (random errors in y have no such effect). He tries to compensate for this defect by separately calculating regression curves to minimize deviations from each of the variables in succession, and then striking a geometric mean of the coefficients. He maintains that where there is uncorrelated error in each of the variables the results of his single-equation, geometric-mean-of-regressions method are closely comparable with those from a system-of-equations method. Working's choice of curve fitting is defensible and accurate for most of his analyses, where R's are high. It may be questioned whether they are equally applicable to instances where

errors in data are sizable and not of equal magnitude for each of the variables.

Working, a painstaking and patient investigator, sets a standard high above that of the calculating-machine analysts of the grind-'em-out-fast school. He examines his basic data meticulously. His proliferation of separate correlations is not a mad pursuit of high R's, but rather an adaptation of various types of analyses to many separate questions and to several commodities. In these respects, Working meets criteria of excellence set up by F. V. Waugh in a recent review, wherein he asks us to "keep our methods flexible" and to "try to understand the economics of each commodity and use whatever methods are appropriate to a particular case." [7]

Perhaps the most disappointing note in the entire Working study is a series of comments in Chapter I. "In the light of present circumstances [1952 shortages and high prices] it may seem almost unbelievable that 20 years ago . . . it became a part of our national policy to restrict the production of meat animals. . . . Whether farmers really benefited . . . was . . . open to question. Then, too, the program was clearly bad for consumers and for workers and management of the meat industry.

"The recent policy of placing direct price controls on meat and livestock appears quite as ill advised as was the former policy of restraining livestock production. It fails to deal with the fundamental cause of the current high meat prices. . . ."

The comments may be correct. Certainly the author has the privilege of making them. As a broad precept it is not only acceptable but desirable to attempt to apply results of research to policy. But in this report it is doubtful whether the subsequent research findings are themselves conclusive substantiation of the observations, for other considerations are involved in such policy decisions. Moreover, the prominence of the comments, coming as they do before the analytical data, is somewhat unfortunate.

The study was stimulated and financed by Oscar G. Mayer, a leader in the meat-packing industry. Industry sponsorship of farm price research is infrequent, and is a practice to be commended. It is essential that research so financed not be related to any need to support or confirm the donor's viewpoints. This is merely an academic interpolation; no lack of objectivity appears in *Demand for Meat*. It is an excellent piece of work.

[7] WAUGH, FREDERICK V. BOOK REVIEW: THE MEASUREMENT OF CONSUMERS' EXPENDITURE AND BEHAVIOUR IN THE UNITED KINGDOM, 1920–38. VOLUME I. BY RICHARD STONE. Agr. Econ. Res. 7: 23–24. 1955.

Book Reviews

Marketing Farm Products. By Geoffrey S. Shepherd. Iowa State College Press, Ames, Iowa. 497 pages. 1955. $6.50.

Marketing of Agricultural Products. By Richard L. Kohls. The Macmillan Co., New York. 399 pages. 1955. $5.25.

Marketing of Agricultural Products. By Max E. Brunk and L. B. Darrah. The Ronald Press Co., New York. 419 pages. 1955. $5.50.

Marketing: Text and Cases. By J. Thomas Cannon and Jack A. Wichert. McGraw-Hill Book Company, Inc., New York. 627 pages. 1953. $6.

THE FIRST THREE of these books are designed to meet the increasing need for textbooks in beginning courses devoted to the marketing of farm products. For the most part, they are well adapted to the purpose, and their similarities exceed their differences. The fourth publication is intended as a textbook for types of courses usually found in a school of business administration or a college of commerce.

This is the third edition of Professor Shepherd's textbook, and he has enlarged and improved on earlier editions. He emphasizes the importance of what he regards as a "clean break with the traditional functional approach," and states that the book represents his efforts to develop a framework of economic theory which will aid the student in analyzing marketing situations and problems.

The book is well-organized and integrated to stimulate student thinking toward solution of marketing problems as well as to provide a description of the marketing process. Starting with the concept of the perfect market in place, time, and form, Professor Shepherd proceeds to apply this concept to the three major areas in the marketing field—demand, prices, and costs.

Elementary theory of demand, factors responsible for the present position and trends in the demand for farm products in the United States, and factors influencing the supply of farm products are developed, together with the role of the marketing system in bringing demand and supply together and the crucial importance of economic information in enabling a marketing system to approach perfection. Then the author applies these concepts to broad problems that cut across commodity lines and he analyzes specific marketing problems for the major groups of agricultural products.

Dr. Kohls has an approach that is not unlike Professor Shepherd's. Part I—The Framework of the Marketing Problem—includes chapters dealing with the nature of marketing problems and methods for studying them, characteristics of the consumption and production of farm commodities, and the size and makeup of marketing costs. Part II—Some Functional Problems—deals with price discovery, competition, movements in agricultural prices, Government programs, standardization and grading, transportation, storage, and related aspects. Part III—Commodity and Institutional Problems—is devoted primarily to the analysis of specific commodities, plus chapters on cooperatives, the role of Government, food processing, and wholesaling and retailing.

Brunk and Darrah have the shortest of the three texts, but they follow somewhat the same sequence as the others, proceeding from a discussion of the nature and development of agricultural marketing through factors affecting demand, consumption, and supply, to an analysis of the marketing functions of pricing, storage, grading, transportation, and buying and selling as operations that bring consumption and supply together. The text concludes with a description of marketing agencies, channels, and costs. In this final section, some attention is given to specific commodities, and, of course, much illustrative material on commodities appears throughout. But the treatment of individual agricultural products is less detailed and analytical in this book than in the other two.

It is always possible to find specific statements

or particular analyses which a reader considers somewhat inadequate or with which he disagrees more or less, and these three books are no exception. For instance, the distinction between demand and consumption is not always made clear either by Shepherd or by Brunk and Darrah.

But the authors of all three of these textbooks for beginners in marketing are to be congratulated for including material designed to implant firmly in the mind of the student the important distinctions between such concepts as demand, consumption, price elasticity, and income elasticity, to mention but a few. Only a person who has had some teaching experience can fully appreciate the extent to which students can be exposed to several courses in economics, yet remain unclear or confused on some of the most elementary yet basic tools of understanding and analysis, with a resulting serious handicap to their later work.

Most of the criticism that might be leveled at these three books, either as to their discussion of concepts or their description of phenomena, probably can be laid to a striving for brevity. There is a conflict between the necessity of covering an extremely broad subject and of limiting the material to a single volume of reasonable size. The authors themselves recognize that many specific details are omitted, that additional illustrations and data are needed to supplement the text. Such supplementation is facilitated in that the books are well annotated.

All three of these textbooks are good. In choosing one over the others, a teacher would be influenced largely by personal preference as to aspects of the marketing field that should receive greatest emphasis, by the extent to which supplementary teaching materials are to be employed, and the background and probable future training and interests of prospective students.

The books by Shepherd and Kohls (particularly the former volume) present more of a framework in theory and give greater emphasis to pricing aspects of marketing. On the other hand, the simplicity and readability of the book by Brunk and Darrah make it well suited to students who have little or no training in economics and to those who plan to specialize in some technical phase of agriculture.

Outstanding chapters in Professor Shepherd's book are those dealing with the concept of the perfect market, decentralized markets, and the importance of production and marketing information to their efficient functioning, the operation of futures markets, and the marketing problems of livestock and meat.

Dr. Kohls provides excellent discussions of the process of price discovery, the collection and use of market information, and transportation. In a special section he discusses briefly the agencies and activities of the United States Department of Agriculture. All three books would benefit by fuller reference to the organization and operation of the Department and of the State agencies, particularly the experiment stations and the extension services, in assisting the agricultural industries through research and extension. Particular emphasis should be given to progress in dealing with problems of marketing research since the Research and Marketing Act of 1946 was enacted.

The book by Brunk and Darrah includes an excellent chapter on transportation, and the entire section on factors affecting consumption is particularly good.

Marketing: Text and Cases is an attempt to combine general explanatory and descriptive material in marketing with the use of cases which the authors say are designed to take students inside an organization, where they can actually come to grips with practical marketing problems. Throughout, the book is essentially the application of the case approach to the study of the marketing of industrial products.

Although it should be of definite interest to teachers of marketing in colleges of commerce and schools of business administration, this book would not have a place as a text in a college of agriculture. More and more agricultural products, however, reach ultimate consumers in forms which bear little resemblance to their state when they leave the farm. One of the real advances of recent years has been the acceptance of the viewpoint that agricultural marketing must be understood all the way from the producers to the ultimate consumers. Teachers of agricultural marketing would do well, therefore, to examine this book with a view to selecting certain cases that might contribute to a well-rounded understanding of some matters that bear on the efficiency of marketing businesses.

Bennett S. White, Jr.

The Nation Looks at Its Resources. Report of the Mid-Century Conference on Resources for the Future. Resources for the Future, Inc., Washington, D. C. 418 pages. 1954. $5.

PROCEEDINGS of this Mid-Century Conference are presented in the form of quotations from some 500 of the 1,600 people who attended the sessions. Each section of the report contains background material, quotations, and a brief summary. Major talks given at the general sessions and at two luncheon and two dinner meetings are given in full, or are summarized. Following are some highlights of discussion reported in chapters that correspond to the eight sections into which the conference was divided.

"Competing Demands for Use of Land" deals with ways of satisfying present and future demands. Ways of reconciling conflicts that arise from increasing demands for farmland and for space for cities, industrial plants, parks, wildlife, military, and other uses were discussed.

"Utilization and Development of Land Resources" is concerned with the fundamental problem of how to assure that in the long run our land base will provide the increased production of foods and fiber, timber, recreation, watersheds, and other things that we will need for higher living standards for our growing population. With more research, better application of known methods, and conservation, it was agreed that our production could be increased to meet future requirements.

"Water Resource Problems" examines major problems of water use and control, and discusses the controversial issues of public policy. The group thought it unfortunate that data about water resources are scarce at a time when programs for water development are under way. Methods of river basin planning and development were considered, and the need for innovations in administrative arrangements was cited. Economic evaluation, though as yet imperfect, can help in selecting the most fruitful undertakings in resource development.

In the section on "Domestic Problems of Nonfuel Minerals" discussion begins with the general assumption that available domestic resources must be enlarged to meet the needs of the expanding economy and to bolster the Nation's security. To create this expansion, stimulation of domestic mineral exploration and development is necessary. Ways of doing this, such as tax modifications, increased surveys and research, improvement in the claims-patent system, tariff, direct subsidies, quotas, and Government purchase, were discussed.

Fuel and water power, and the achievements of science and technology in developing these resources are considered under "Energy Resource Problems". Our energy resources will be abundant for many years, and those fuels that are exhausted first can be replaced by other types. Nuclear energy and other sources of energy (notably solar energy) lie ahead if we maintain a vigorous program of research.

Such issues as: What should the United States commercial policy be with respect to imports of raw materials? What are the most effective means by which development of resources abroad can be assured? Is it desirable to use special devices to stabilize raw material prices? are considered under "U. S. Concern With World Resources".

"Problems in Resources Research" discussed the part that technology will play in future conservation and use of resources. Concern was expressed with regard to the training of young research people, and whether a continuous flow of scientific personnel can be maintained. The research group expressed faith in the belief that technological progress would help solve resource problems in the next generation.

"Patterns of Cooperation" deals with relations between citizens, organizations, and government at all levels, through which programs of research, planning, education, and action affecting natural resources are carried on. Resource problems should be increasingly emphasized in both youth and adult education.

The greatest benefit of the conference will come from work growing out of ideas stimulated by discussion. The 1,600 participants included many leaders in the resource use and conservation field. The report will refresh the memory of those who attended. Those who did not attend will obtain from it a good idea of the scope and nature of the resources problem and of the discussion that took place.

Harry A. Steele

Food and Agriculture in Britain, 1939–45; Aspects of Wartime Control. By R. J. Hammond. Stanford University Press, Stanford, California. 246 pages. 1954. $5.

Wartime Agriculture in Australia and New Zealand, 1939–50. By J. G. Crawford, C. M. Donald, C. P. Dowsett, and D. B. Williams; and A. A. Ross. Stanford University Press, Stanford, California. 354 pages. 1954. $7.50.

THESE PUBLICATIONS are in a series of some 20 volumes scheduled to be published by the Food Research Institute on food, agriculture, and World War II.

R. J. Hammond substitles his book "aspects of wartime control" to disclaim any pretense of completeness. His study is based on extensive research into the official unpublished records of the Ministry of Food which he carried out as the historian on food policy for the United Kingdom Official War Histories. The result of this work, which is now being published, will contain more detailed description and appraisal than the present publication. It is in the United Kingdom series that the historian will find the documentation on which this summary account and analysis is based.

The author has not hesitated to discuss conflicting points of view within the British Cabinet or between Britain and the United States. In the fragment that follows, taken from the chapter on overseas supplies and stocks, Mr. Hammond appraises factors influencing Britain's relations with other countries:

"The United Kingdom's genuine desire that there should be fair shares all round was modified by a conviction that the United Kingdom share ought to be fairer (if one may so put it) than that of the other European Allies; the desire to cooperate with the United States constantly warred with a wish to reinsure, somehow or other, the British position against the inaccountable vagaries of American policy. . . . There were, of course, good solid reasons that could be urged to members of the Grand Alliance in support of this policy. But at bottom it was one of self-interest—enlightened, maybe, but impossible to disguise; and as such it had the character of a stubborn retreat covered by repeated rearguard actions."

Two of the 12 chapters are devoted to problems and accomplishments in home food production. The author stresses the problems encountered in forecasting home food production, using the potato, which "defied all planning," as an example. British food policy, the author concludes, was to draw much of its strength from its very dependence on overseas supplies. Control of milk, the welfare element in food policy, and communal feedings are discussed, and wartime controls over food marketing and distribution are covered on a chronological basis.

This book maintains the high standards for clear and entertaining writing, balanced treatment of events, and critical analysis established by the author in his 1951 volume on wartime food policy. As a philosophical appraisal of the problems of wartime control it will be of particular value to those who are responsible for planning emergency food policies.

Wartime Agriculture in Australia and New Zealand, 1939–50 is divided into two separate sections with the major part of the book, 237 pages, concerned with the experience of farming industries in Australia. This part was written jointly by four men who held responsible positions in the Government. The section on New Zealand, 117 pages, was written by the official historian of the New Zealand Department of Agriculture. The authors had access to official unpublished records of their governments.

Each section begins with a background description of agriculture and emphasizes that it was in a state of disequilibrium in relation to the rest of the economy at the outbreak of war. The authors also emphasize the surplus complex growing out of this disequilibrium and the depression experience of the thirties. Both parts of the book conclude with chapters on postwar problems and stress factors that hamper substantial increases in agricultural productive capacity. Appendixes on Australia and New Zealand include statistical tables on population, employment, land use, crop and livestock production, farm machinery, fertilizer, imports, and exports. The appendix on Aus-

tralia includes a selected bibliography, copies of some orders and regulations, and a chronology of major wartime events.

The Australian section gives a chronological account of agriculture as a war industry and includes chapters on specific commodities, problems arising from shortages of rural manpower and scarce materials, price policy, and the distribution of agricultural products. The authors criticize the Prices Commission, which was represented on the Production Goals Committee, for failing to take cognizance of production goals in the determination of price stabilization policy. The authors state: "At no time was there an effective acceptance of the principle that prices could and should be used as a purposeful instrument in stimulating production of particular commodities at the expense of others."

Mr. Ross concludes that the weaknesses in New Zealand during the war years "sprang mainly from absence of planning and control, not from misplanning." He is particularly critical of the failure of manpower authorities to designate farming as an essential industry but notes that farm organizations were opposed to such designation.

This book offers valuable information on agriculture in Australia and New Zealand and helpful material on wartime controls in surplus-producing countries.

Gladys L. Baker

Freedom in Agricultural Education. By Charles M. Hardin. University of Chicago Press. 275 pages. 1955. $4.50.

AT THIS TIME, when there are fears of domination if the Federal Government provides funds for education, it may surprise some to learn that the State Land Grant Colleges and Universities and their agricultural research and extension work which have been supported in a considerable part by Federal funds for many years are not pressured by the Federal Government.

Such is the conclusion of this author after an extensive survey of the influence of Federal funds on college education and research. The study, which is based largely upon interviews, was sponsored by the Commission on Financing Higher Education, established by the Association of American Universities.

The author finds that intrastate pressures "have by far the most significant influence on educational activities in the colleges." In fact, he concludes that Federal support of education and research has been one bulwark against intrastate pressures and politics. The main wielders of pressures are shown to be the State and local farm organizations and commodity associations and their leaders. Examples of such pressures are discussed in chapters devoted to "Low Nicotine Tobacco in Kentucky" and the "Iowa Margarine Incident."

Pressures on the part of the Federal Government, chiefly indirect, are discussed throughout the book. Detailed examination of this problem is found in chapters on "The Political Influence of Agricultural Action Agencies" and "The Pennsylvania Controversy Over Federal Grants for Agricultural Extension."

Pressures on Federal economic research are mentioned, with an extensive discussion of the former Bureau of Agricultural Economics as an example. Three chapters are devoted to this topic. Apparently more space than is needed is given to making the point that the research carried on in BAE was inherently controversial, but the author exercises his right to give such space to his special interest.

Emphasis is placed on the conservatism of the officials of the universities and colleges. The author does not define "conservatism" but attempts to illustrate with examples. He concludes that "the temper of most agricultural college personnel seems typically to range from moderately to rather markedly conservative. . . . America is fortunate in the temperance of its agricultural leadership; but, in the present and prospective social

tensions, temperance by itself will prove insufficient. Enlightened and vigorous statesmanship will be required."

Officials, faculties, research and extension workers in land-grant colleges and universities, farm organization and commodity association leaders, federal agricultural workers, and all who have any concern about political pressures on education will find this book interesting and useful reading.

T. Roy Reid

Contributions of Survey Methods to Economics. By George Katona, Lawrence R. Klein, John B. Lansing, and James N. Morgan; edited by Lawrence R. Klein. Columbia University Press, New York. 269 pages. 1954. $5.

ECONOMISTS have long sought to broaden the scope of economics by integrating aspects of the other social sciences. Through the use of the annual Surveys of Consumer Finances (SCF) conducted for the Federal Reserve System by the Survey Research Center of the University of Michigan's Institute of Social Research, the contributors to this volume have made such a move by treating economic problems in consumer behavior within the framework of sociological and psychological theory as well as economic. Happily, Lawrence Klein points out in the introduction, "it is the essence of survey research that several branches of social science can be combined in any particular application." Concerned as agricultural economists are with the effects of consumer behavior on demand, this book, although directed at a different audience, should help them in applying cross-sectional survey data to their work.

The initial chapter by John B. Lansing presents the definitions used in the SCF and compares the conceptual problems accompanying them with those used by the Department of Commerce in estimating national income. The major difference is that the Survey estimates income and saving directly; consumption is a residual. The National Income statistics measure income and consumption directly. While savings, as defined for the SCF, can be recalled more accurately than consumption, economists concerned with measuring demand at a less than aggregate level would welcome the opportunity which recurrent surveys could provide to obtain consumption expenditures by items or groups.

George Katona, who has been in the fore of those studying economic behavior from the aspect of peoples' motivations, attitudes, and expectations, may be described as the economist who places consumers on the analyst's couch. Distinguishing between genuine decision-making and habitual behavior, consumer money outlays are classified into a 2 x 2 matrix of spending or saving and of habitual outlays or outlays of choice (variable outlays). The latter are postulated as having a much greater "residual variance" (variance unexplained by a few such traditional variables as income and assets) than the habitual outlays. Katona's contribution to the fusion of the several social sciences comes when he analyzes economic trends in relation to attitudinal data from the SCF conducted in 1951 and 1952. Although much work remains to be done, opinions and expectations gleaned from survey data about future changes in prices and economic conditions do appear to be correlated with spending behavior.

Departing from the SCF concept of saving, and including purchases of durable goods as an asset accumulation, James N. Morgan presents an explanation of saving-income relationships. Ambitiously, residuals from regressions of saving on income, after adjustment for liquid assets, home ownership status, and several other factors, were studied for their relation to economic, psychological, and demographic variables. Two interesting—because unexpected—results were: First, other saving was not reduced proportionally when contractual saving was present, indicating imperfect substitutability of saving components; and second, there was no relation between saving be-

havior and rent level of the block or dwelling. As Morgan points out, the second result seemingly contradicts the hypothesis that saving behavior depends on the economic status and consumption pattern of those living near, or with whom the spending unit associates. Both results indicate the need to reconsider concepts relating to saving saturation and reference group expenditures.

The task that Klein undertakes is the construction of a model of savings behavior and a topical treatment of the applications of survey methods and data to business-cycle analysis. Through the use of multivariate regression analysis, savings are studied in relation to economic, attitudinal, demographic, and sociological variables. Although the greater part of this material is not new, it does afford a systematic presentation of savings-behavior analysis.

With increasing emphasis being placed on the use of survey data, it is fortunate that the concluding chapter points out the limitations of survey data in analyzing economic fluctuations as well as the limitations of survey data per se. For example, this reviewer has made a rough test of the predicting ability of one attitudinal category reported in the SCF—percentage of spending units planning to buy new cars. The percentage data for 1948 to 1954 were combined with Department of Commerce statistics on spending units to yield planned purchases. Those, compared with new car registrations for the same period, are as follows:

Year	Planned new car purchases	New car registrations
	Millions	*Millions*
1948	4. 9	3. 5
1949	6. 1	4. 8
1950	5. 6	6. 3
1951	3. 5	5. 1
1952	3. 6	4. 2
1953	4. 9	5. 7
1954	4. 3	5. 6

Certainly, Klein's remark is well taken that "having an income increase or getting at least as much income as expected is significant in leading one to fulfill purchase intentions." But, since 1950, have the automobile salesmen been as effective as the difference between intentions and registrations would indicate?

Martin J. Gerra

The Farm as a Business: A Handbook of Standards and Statistics for Use in Farm Management Advisory Work. Prepared by the Ministry of Agriculture and Fisheries. Her Majesty's Stationery Office, London. 107 pages. 1955. 4 shillings.

FARM MANAGEMENT advisory work (extension) in England and Wales has been expanded greatly during the last few years. Publication of this handbook, prepared for the British equivalent of our extension economists and county agents—Provincial Economists and District advisory officers—is evidence of increased interest in efficient farm management in Britain.

The writers suggest that the application of the principles of farm management, as developed in a well-thought-out farm plan, will aid the farmer to attain his objectives.

Certain principles of planning—the same ones with which our farm management specialists are familiar—are given; and two measures of evaluation of the present production program that are new to this reviewer. These are the "System Index" and the "Yield Index."

The System Index is based on the output, in terms of value, which the production program of the farm would be capable of producing under conditions of average yields. When the results are compared with the average for similar farms in the district, it is possible to tell whether this particular combination of enterprises is average, above, or below, in terms of a high profit combination and intensity of resource utilization.

The Yield Index is obtained by expressing actual output as a percentage of average output for the same farming system. This figure indicates the relative skill of operators and the adequacy of operating practices followed on individual farms.

These two indices together, according to the authors "indicate whether the major weaknesses lie in the choice and organization of the farm enterprises, in the technical efficiency of production as reflected by the level of yields, or both".

Customary factors used in measuring efficiency of farm operation and management are described and their use is illustrated. "In farm planning the process of studying past results is an essential preliminary," the handbook says, adding that preferably 3 or 4 years of statistical data should be considered. Moreover, such data must be compared with similar figures for a group of comparable farms in the vicinity.

Budgeting and partial budgeting are introduced briefly, with two elementary illustrations of partial budgeting. Basic data for use in budgeting occupy the remaining half of the handbook.

Apparently the British approach to farm management extension differs in several respects from that of the United States. The most striking difference, possibly, is the British comparison with regional averages. In this country we generally set the average of superior operators—frequently the top third or fourth of the group—as the goal toward which the individual aims. In the British view, individual farming accomplishments *must* be compared with similar figures for comparable farms. We know from experience that, although desirable, such comparison is not essential in planning farms in this country.

The handbook contains data—generally an average figure only—needed to measure the efficiencies of the existing farming system, but it does not appear to furnish information required in budgeting to correct weaknesses uncovered by analysis. Possibly this information is supplied elsewhere. One wonders whether in Britain, as in the United States, the most pressing present need is for more input-output data, particularly for variable levels of inputs.

In Britain, apparently Advisory Officers do the budgeting for farm families. In the United States extension workers teach the farm families to do their own budgeting. Then, too, we find the farm wife as much concerned as her husband with farm replanning—or the whole family pitches in and does it as a joint enterprise. This apparently is in decided contrast with British custom.

No reference is made in the handbook to the availability of prepared forms for use in developing farm plans. If the development of better farm management plans is an important objective of the British Advisory Service, availability of planning forms will certainly facilitate them.

The handbook, the writers emphasize, is still experimental and revisions may be expected as experience is gained. It is a good beginning and should do much to stimulate increased farm planning by Advisory Officers and farmers.

James E. Crosby, Jr.

Atlas of the World's Resources. Volume I: The Agricultural Resources of the World. By William Van Royen, in cooperation with the Bureau of Agricultural Economics, United States Department of Agriculture. 258 pages of maps, with accompanying text and selected references. Published for the University of Maryland by Prentiss-Hall, New York. 1954. $13.35.

AT FIRST THOUGHT, *The Agricultural Resources of the World* may seem too pretentious a title for an atlas that shows primarily the geographical distribution of agricultural production. But in view of the lack of distribution data, on a world basis, for some agricultural resources, perhaps we should not labor this slight strain on terminology. One can put on maps only that which has been enumerated by area or otherwise located. The atlas does show, principally by means of dot maps, acreage of the principal crops and numbers of livestock for most parts of the world.

What we have here is something that corresponds, on a world basis, to the crop and livestock parts of the "Graphic Summaries" of American agriculture, published by the Census in cooperation with the former Bureau of Agricultural Economics of the United States Department of Agriculture. The late O. E. Baker, to whose memory this atlas is dedicated, had much to do with the inception of both.

The value of this atlas is not merely in its graphic representation of the distribution of crop acreage and production and livestock numbers among countries, but in showing location of production within countries. Just as it is important for many reasons for us to comprehend the distribution of production within our own country and within our States, we need also to be aware of the geography of production within other countries, if we are to be intelligent in our greatly intensified activities in relation to those countries.

World maps show the general distribution of landforms, climatic types, precipitation, soil groups, and world population. There are also maps of some of the continents and subcontinental areas showing the general distribution of major land uses. Identification maps give the names of civil divisions shown on the base maps of different countries, other than the United States and Canada.

One is puzzled by the omission of the time period involved for most of the maps that show acreage or production, including those of the United States and Canada. Even if the period for most of the foreign countries is pre-World War II, as the text leads one to believe, it would seem better to tell the reader this rather than to let him guess.

One also wonders why an atlas that attempts to show distribution of agricultural resources devotes several pages to work animals but has no map of the distribution of tractors; data for such a map are available in the FAO Yearbook. That Yearbook includes data also on agricultural workers and on fertilizer production and consumption—subjects that would appear to warrant treatment in this atlas. However, a work of this kind takes a long time to prepare; new data that become available as compilation progresses cannot all be added, or the publication would never go to press.

For its information about the geography of agriculture within other countries, this atlas is a valuable reference. No other publication provides such information in equivalent completeness and detail. It should be in every general reference library.

Carleton P. Barnes

Selected Recent Research Publications in Agricultural Economics Issued by the United States Department of Agriculture and Cooperatively by the State Colleges [1]

Brensike, V. John, and Askew, William R. costs of operating selected feed mills—as influenced by volume, services, and other factors. U. S. Dept. Agr. Mktg. Res. Rept. 79, 45 pp., illus. February 1955. (Agr. Expt. Stas. of Iowa, Oreg., and Tenn. cooperating.)

Feed-mixing plants with an annual volume of 30,000 tons or more operated at average costs per ton 50 percent less than plants mixing about 2,000 tons of feed a year. It was calculated that total operating costs per ton in 1952 were about $10.40 in plants mixing 30,000 tons a year, $12.90 in plants mixing 10,000 tons, and $20.70 in plants mixing 2,000 tons.

Brodell, Albert P., Strickler, Paul E., and Phillips, Harold C. extent and costs of spraying and dusting on farms—1952. U. S. Dept. Agr. Statis. Bull. 156, 25 pp. April 1955.

Spraying of field crops for weeds began about 50 years ago, but methods of application have undergone continuous change since the first traction sprayers appeared. Newer and more effective pesticides continually come into use. With these new developments, acreages of farm crops and farmland treated for pests have expanded markedly, and purchases of power sprayers and power dusters in recent years have been more than six times the average annual purchases of the prewar period.

Brooker, Marvin A., and Gilbraith, Kenneth M. factors influencing the method of transportation used in marketing fresh florida citrus. Univ. of Fla. Bull. 549, 80 pp., illus. (Under contract with U. S. Dept. Agr.) September 1954.

Problems of transporting fresh citrus to market have been caused more by changes in geographic distribution of the fresh fruit and by methods of selling than by increased production. Interstate shipments to the Northeast have decreased and those to the North Central and Southern regions have increased; the auction method of selling has declined, and the f. o. b. method has become more important; use of rail and water facilities has declined, and use of motor trucks has increased.

Browner, V. L., and Pauli, Hans. space allocation for grocery items in food stores. U. S. Dept. Agr. Mktg. Res. Rept. 80, 22 pp., illus. February 1955. (RMA)

Approximately 30 percent of the grocery items studied in 11 retail food stores had average sales of one unit a week or less. Averages for 9 of the stores showed no sales for 6.5 percent of all items studied during the 4-week period; 1 to 5 unit sales for 23.4 percent of the items; 6 to 10 units for 13.8 percent; 11 to 20 units for 18.3 percent; 21 to 30 units for 18.3 percent; and more than 30 units for 27.2 percent of all items.

Carlsen, Earl, W., and Herrick, Joseph F., Jr. innovations in apple handling methods and equipment. U. S. Dept. Agr. Mktg. Res. Rept. 68, 89 pp., illus. January 1955.

One objective of research being conducted in Washington State apple houses on materials handling was to develop and test methods for using present equipment and to introduce and test some of the newer types of equipment. This report gives results of tests, under actual operating conditions, of eight innovations in handling apples.

Chryst, Walter E., and Timmons, John F. adjusting farm rents to changes in prices, costs, and production. Iowa Agr. Expt. Sta. Spec. Rept. 9, 44 pp., illus. April 1955. (Iowa State College Agricultural Foundation and ARS cooperating.)

From the analysis of rents on the farms studied, two main deductions may be made as to why rents fail to keep pace with prices, costs, and production: (1) Wide fluctuations in the net rent ratios appeared for all kinds of rent. (2) The kind of rent apparently affects the direction of the trend in net return ratios. More flexible leasing provisions are needed.

Culpepper, C. W., Haller, M. H., Demaree, K. D., and Koch, E. J. effect of picking maturity and ripening temperature on the quality of canned and frozen eastern-grown peaches. U. S. Dept. Agr. Tech. Bull. 1114, 32 pp., illus. April 1955.

Rate of ripening was about equally fast at 65°, 75°, and 85° F. At 95° it was slightly slower and the fruit softened less in ripening. Peaches ripened in 4 to 6 days at 85° or 2 days at 95° made a product that was rated about equally with that made from tree-ripened fruit. Cold storage for 2 weeks did not adversely affect the quality of the peaches if ripening occured after storage.

Drewniak, Edwin E., Baush, Edward R., and Davis, Lyle L. carbon dioxide immobilization of turkeys before slaughter. U. S. Dept. Agr. Cir. 958, 9 pp., illus. (RMA)

Putting turkeys to sleep with carbon dioxide gas could improve commercial slaughtering practices by reducing struggles of the bird and resultant bruises, broken bones, and similar injuries.

Ellis, Harold, Barlowe, Raleigh, and Hill, E. B. how michigan inheritance laws affect farm ownership and operation. Mich. Agr. Expt. Sta. Spec. Bull. 395, 35 pp. January 1955.

[1] Processed reports are indicated as such. All others are printed. State publications may be obtained from the issuing agencies of the respective States.

Reports what happened in the settlement of farm estates in a selected Michigan township over a 26-year period.

FRENCH, BURTON L. FARM RENTAL PRACTICES AND PROBLEMS, NORTH CENTRAL STATES—METHODOLOGICAL REPORT OF STUDY. U. S. Agr. Res. Serv. ARS 43–8, 53 pp., illus. March 1955. (Farm Foundation and State Agr. Expt. Stas. cooperating.)

In conducting the regional study on farm rental practices and problems, questions arose concerning various alternative procedures. Answers to many of the questions were not available in previous research. This situation led to the preparation of this report, which is intended to permit the sharing of experiences gained in the study and to present a systematic accounting of the procedures for technicians who use the results of the regional leasing study.

GERALD, JOHN O., and KAHLE, HUMBERT S. MARKETING GEORGIA BROILERS THROUGH COMMERCIAL PROCESSING PLANTS. U. S. Dept. Agr. Mktg. Res. Rept. 83, 53 pp., illus. March 1955. (RMA)

Broiler processing plants in north Georgia aided in the efficient marketing of the 100 million dollars worth of broilers produced in Georgia in 1953 and contributed about 30 million dollars to the nonfarm income of that State.

HEINZE, PETER H., KIRKPATRICK, MARY E., and DOCHTERMAN, ELSIE F. COOKING QUALITY AND COMPOSITIONAL FACTORS OF POTATOES OF DIFFERENT VARIETIES FROM SEVERAL COMMERCIAL LOCATIONS. U. S. Dept. Agr. Tech. Bull. 1106, 69 pp., illus. March 1955.

Results of tests indicated that the method of cooking made little difference in the mealiness, dryness, and flavor of potatoes, but that the color of boiled potatoes was poorer than that of mashed or baked potatoes. Dry matter, alcohol insoluble solids, starch, or specific gravity were found to be almost equally good measures for predicting the cooking quality, but specific gravity was the simplest and most practical measure.

HOOFNAGLE, WILLIAM S., DWOSKIN, PHILIP B., and BAYTON, JAMES A. THE MARKET FOR FOOD IN SELECTED PUBLIC AND PRIVATE INSTITUTIONS. U. S. Dept. Agr. Mktg, Res. Rept. 84, 38 pp. March 1955. (RMA)

Penal, charitable, and mental institutions comprise an outlet that has received little attention in market analysis. According to the 1950 census, more than 1½ million persons were living in public or private institutions. Mental institutions and homes for the aged may be important outlets for surplus foods.

JENNINGS, R. D. RELATIVE USE OF FEEDS FOR LIVESTOCK, INCLUDING PASTURE, BY STATES. U. S. Dept. Agr. Statis. Bull. 153, 59 pp., illus. February 1955.

Corn, excluding silage but including corn in formula feeds, accounted for about 26 percent of all feed nutrients, including pasture, consumed by all livestock in 1949–50. All other grains and byproduct feeds added to about 18 percent. Hay was about half as important as corn, but pasture grazing amounted to about 37 percent. Thus roughage and forage were more important in the national feed supply than were grains and other concentrates.

JENSEN, HARALD R., HEADY, EARL O., and BAUMANN, ROSS V. COSTS, RETURNS AND CAPITAL REQUIREMENTS FOR SOIL-CONSERVING FARMING ON RENTED FARMS IN WESTERN IOWA. Iowa Agr. Expt. Sta. Res. Bull. 423, pp. 267–287. March 1955. (ARS, SCS, and ACPS cooperating).

This study was designed to determine the conditions under which tenant and landlord net incomes can be increased by shifting from a soil-exploitive cash-grain farming system to soil-conserving farming systems that will involve different degrees of adjustment in terms of capital and cost outlays.

JOHNSON, DEHARD. FROZEN FOOD MOVEMENT INTO RETAIL OUTLETS. A TEST OF THE FEASIBILITY OF MEASURING FROZEN FOOD MOVEMENT AT THE WHOLESALE LEVEL. U. S. Agr. Mktg. Serv. AMS–19, 9 pp., illus. March 1955. (Processed.) (RMA)

Gives results of a pilot study conducted in Washington, D. C., and Philadelphia to provide the frozen food industry with information on how it might carry out a reporting program and what might be expected of such a program.

KRIESBERG, MARTIN. IMPROVING THE EFFICIENCY OF RETAIL GROCERY CLERKS BY BETTER TRAINING. U. S. Dept. Agr. Mktg. Res. Rept. 82, 38 pp., illus. March 1955. (RMA)

Emphasis on employee participation in work improvement programs was followed by increased sales of $4.96 per clerk hour. In two other methods of introducing the same work practices, the gains in sales per clerk hour were $3.47 and $1.33.

LEE, W. A., and CARROLL, W. M. EFFECTS OF METHODS OF PACKAGING APPLES ON RETURNS TO PENNSYLVANIA GROWERS, 1953. Pa. Agr. Expt. Sta., State College, Pa. 62 pp., illus. (AMS and Pa. Agr. Ext. Serv. cooperating.) (Processed.)

Methods of packaging have changed considerably in the apple industry in recent decades. A few years ago it was common to characterize eastern apples as bushel packs, whereas western apples were largely packed in boxes. In recent years, the wrap-and-count box pack has become common with Pennsylvania growers. More recently, packers have been experimenting with newer containers, such as the fiberboard containers and consumer packages in film or mesh bags. The variety of containers available complicates the choice and emphasizes the need for cost and return information that will aid the packer in choosing a container.

MASTERS, B. M., WINTER, J. C., and ROSANOFF, B. P. POTENTIAL SAVINGS BY SHIPPING CAULIFLOWER IN DOUBLE-LAYER PACKS. U. S. Dept. Agr. Mktg. Res. Rept. 78, 16 pp., illus. March 1955. (RMA)

Through methods used in the study, freight charges on the experimental containers, projected to a carlot basis, would be reduced from 8.7 to 5.1 cents a head, refrigeration charges from 2.6 to 1.5 cents, and container costs from 3.9 to 2.4 cents. Although packing labor costs would be increased from 0.6 cent to 1.1 cents a head, the overall reduction would amount to 5.7 cents, 36 percent of the 15.8 cents currently paid by the industry.

NICHOLS, RALPH R. DIRECTORY OF PERSONNEL IN RURAL SOCIOLOGY: TEACHERS, RESEARCH WORKERS, EXTENSION WORKERS. U. S. Agr. Mktg. Serv. AMS–24, 31 pp. April 1955. (Processed.)

REUSS, L. A. FLORIDA'S LAND RESOURCES AND LAND USE. Fla. Agr. Expt. Sta. Bull. 555, 52 pp., illus. November 1954. (ARS cooperating.)

Contains many basic facts concerning the land resource base of Florida's agriculture, the present uses of the land, and the changes taking place in land use.

ROSS, JOHN E., JR. SOME ECONOMIC CONSIDERATIONS IN STORING SEED COTTON AT GINS. U. S. Dept. Agr. Mktg. Res. Rept. 87, 28 pp., illus. April 1955.

Costs for hauling and storing seed cotton at gins can be reduced, and more storage facilities made available, by using low-bed trailers towed by tractor or truck for hauling and temporary storage. This report analyzes the operating costs of selected gins in the San Joaquin Valley and the Yazoo-Mississippi Delta area, with different types of storage facilities, and discusses the effects of seed cotton storage on the quality and value of ginned lint.

SLUSHER, M. W. ENTERPRISE COSTS AND RETURNS ON RICE FARMS. Ark. Agr. Expt. Stat. Bull. 549, 34 pp. February 1955. (ARS cooperating.)

This bulletin is intended to supply farmers with information concerning profitable uses for land taken out of rice, in order to offset the reduced income from the rice enterprise. Production items, costs, and returns from oats, soybeans, lespedeza, corn, cotton, beef cattle, and other livestock are compared with those from rice.

SMITH, HUGH M. MERCHANDISING STUDIES IN SUPERMARKETS—APPLES, LETTUCE, AND TOMATOES. (A preliminary report.) U. S. Agr. Mktg. Serv. AMS–18, 9 pp. March 1955. (Cornell Univ. Agr. Expt. Sta. and Pa. Agr. Expt. Sta. cooperating.) (Processed.)

Alternative methods of merchandising were evaluated by measuring consumer purchases using application of rotational type experimental designs to eliminate time and store differences.

STANTON, JANET R. FARM-OPERATOR FAMILY LEVEL-OF-LIVING INDEXES, BY STATES, 1950 TO 1954. U. S. Agr. Mktg. Serv. AMS–26, 10 pp., illus. May 1955.

The index of level of living of farm-operator families in 1954 was 34 percent above the index for 1945. With 1945 used as a base of 100, the average county had an index of 75 in 1930, 79 in 1940, 122 in 1950, and 134 in 1954. The increase between 1940 and 1954 was 70 percent. The rate of increase has slackened somewhat since 1950.

SWANTZ, ALEXANDER. PRICES AND OTHER PAYMENTS FOR MILK BY MANUFACTURERS IN KANSAS, MISSOURI, AND OKLAHOMA MARKETS. U. S. Dept. Agr. Mktg. Res. Rept. 81, 40 pp., illus. March 1955. (RMA)

This study covers the practices of 33 unregulated milk processing plants to determine how accurately the announced paying prices reflect prices actually paid and the composition, size, characteristics, and effects of supplemental payments made in the form of premiums for quality and volume, patronage refunds, bonuses, and hauling subsidies.

THAIR, PHILIP J. MEETING THE IMPACT OF CROP-YIELD RISKS IN GREAT PLAINS FARMING. N. Dak. Agr. Expt. Sta. Bull. 392, 34 pp., illus. June 1954. (ARS cooperating.)

The focus of the study was on the variability and uncertainty of farm income in North Dakota. The specific problem investigated had to do with the significant part of income variability that is caused by annual variations in crop yields and to the part of the impact of this variability that constitutes the danger of bankruptcy. The vulnerability of farmers in high-risk farming areas, the degree to which farmers are sensitive to the risk of bankruptcy, and the ways in which farmers try to protect themselves against this risk were investigated.

UNITED STATES AGRICULTURAL MARKETING SERVICE. COTTON TESTING SERVICE: TESTS AVAILABLE, EQUIPMENT AND TECHNIQUES, AND BASIS FOR INTERPRETING REPORTS. U. S. Agr. Mktg. Serv. AMS–16, 29 pp., illus. February 1955.

Describes various cotton fiber and manufacturing tests available on a fee basis under the Cotton Testing Service Act, the methods employed in making the tests, and the significance of the test results.

UNITED STATES DEPARTMENT OF AGRICULTURE. DEVELOPMENT OF AGRICULTURE'S HUMAN RESOURCES. A REPORT ON PROBLEMS OF LOW-INCOME FARMERS. 44 pp., illus. April 1955.

General recommendations as to the changes needed in connection with these low-income farmers include expanded technical assistance and extension work, both Federal and State, among them; more intermediate term credit; more Farmers Home Administration funds; State-Federal research program; improvement in State employment services; additional programs for rural industries;

more educational and vocational training opportunities for these families; improved health programs in rural areas; and establishment of trade area and community development programs in these areas.

United States Agricultural Marketing Service. Food distribution research, educational and service work of the U. S. Department of Agriculture. U. S. Agr. Mktg. Serv. AMS–37, 26 pp. May 1955. (Processed.)

This report furnishes a brief but comprehensive statement on the research, educational, and service work currently underway in the Department on food distribution.

United States Agricultural Marketing Service. Summary of fiber and spinning test results for some varieties of cotton grown by selected cotton improvement groups, crop of 1954. U. S. Dept. Agr. Agr. Inform. Bull. 137, 43 pp., illus. February 1955.

The general trend indicates that cotton quality has improved during the last 9 years. American farmers are growing cotton that is longer, stronger, and finer fibered than that produced a few years ago. Changes in fiber quality, which have been reflected by an increase in average yarn strength, are due to the work of cotton breeders, to improved production practices, and to increased use of one-variety programs by communities and States.

Voegeli, Lawrence J., White, Edgar F., Masters, Bryce, and Breakiron, P. L. Packing and shipping lettuce in fiberboard cartons and wooden crates—a comparison. U. S. Dept. Agr. Mktg. Res. Rept. 86, 30 pp., illus. (RMA)

Substantial savings are being realized by shippers by dry-packing lettuce in fiberboard cartons in the field or packing sheds and vacuum-cooling it for shipment, as compared with ice-packing in WGA wooden crates in packing sheds. Net savings amounted to $80 per car on lettuce vacuum-precooled and shipped from the Imperial Valley to New York City. When cartons drypacked in the field were cooled in the refrigerator car with car fans and bunker ice, comparable savings were $150 per car.

Webb, Robert W. Improved equations for predicting skein strength of carded yarn with special reference to current commercial production of American cotton. U. S. Dept. Agr. AMS–13, 18 pp. April 1955. (Processed.)

Presents two new count-strength-product equations for predicting skein strength of carded warp singles yarn of any size over a wide range. The new equations are better adapted for predicting strength of yarn processed from the general run of American upland cottons than are similar count-strength-product equations published previously by the Cotton Division.

Statistical Compilations

United States Agricultural Marketing Service. Broomcorn: acreage, yield, production, price and value of production, by States, 1915–52. U. S. Dept. Agr. Statis. Bull. 155, 14 pp. February 1955.

United States Agricultural Marketing Service. Commercial vegetables for fresh market—usual planting dates; usual harvesting dates; principal producing areas, by seasonal groups and States. U. S. Dept. Agr. Handb. 80, 120 pp., illus. December 1954.

United States Agricultural Marketing Service. Grain and feed statistics through 1954. U. S. Dept. Agr. Statis. Bull. 159, 99 pp. March 1955.

United States Agricultural Marketing Service. Space, service requirements, equipment, and supplies for a small seed-testing laboratory. U. S. Dept. Agr. AMS–21. 8 pp. March 1955. (Processed.)

United States Agricultural Marketing Service. Wheat: acreage, yield, and production, by States, 1866–1943. U. S. Dept. Agr. Statis. Bull. 158, 69 pp. February 1955.

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